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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/526,918	11/14/2005	Richard P. Anderson	ITP 34	7530

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EXAMINER	
SHEVIN, MARK L	

ART UNIT	PAPER NUMBER
1793	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/526,918	ANDERSON ET AL.	
	Examiner	Art Unit	
	Mark L. Shevin	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 15 September 2008 and 09 October 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,2 and 6-25 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1, 2, and 6-25 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 1, 2, and 6-25, filed September 15th, 2008 are pending. Claims 1 and 16 were amended and claims 3-5 were cancelled.

Acknowledgement of RCE

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 9th, 2008 has been entered.

Claim Rejections - 35 USC § 103

3. **Claims 1-2 and 6-25** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Armstrong** (US 5,958,106) in view of **Keller** (US 2,846,303).

Armstrong:

Armstrong is directed to a continuous method of producing a non-metal element or a metal or an alloy thereof, particularly titanium (Abstract and Fig. 1). Armstrong reviews the history of titanium metal production stating that "the reduction of titanium tetrachloride to metal has been attempted using a number of reducing agents including hydrogen, carbon, sodium, calcium, aluminum, and magnesium" (col. 1, lines 33-36). One object of the invention is to operate the reaction and separation processes to avoid

sintering the titanium product into large masses (col. 2, lines 43-47). A second object of the invention is to recycle the reducing agent (col. 2, lines 48-54).

Process Flexibility

The metal production method of Armstrong may be practiced with any alkali or alkaline earth metal and any combination of halides to reduce a variety of metals or non-metals (col. 3, lines 16-28, see also Table 1). It is possible to make alloys of a predetermined composition by varying the ratio of halides introduced as reactants (col. 3, lines 29-34). Lithium, potassium, as well as calcium and other alkaline earth metals are available and thermodynamically feasible to be used as reagents and alloy products can be produced by providing a suitable halide feed in the molecular ratio of the desired alloy (col. 7, lines 40-56).

Separation

The desired titanium metal solids are separated from the liquid metal reactants and salts in element **15** (Fig. 1 – Product separator) which may be a conventional separator including a particulate filter after being carried in by a stream of sodium (col. 4, lines 18-23). In one method taught for the separation of the titanium product, residual sodium and sodium chloride would be washed from the titanium product using a water-alcohol wash. Filtration is used to remove products from the bulk sodium. A filter **26** was connected to the outlet of the reaction vessel and used to separate titanium product. The reaction product titanium was washed with ethyl alcohol to remove sodium and water to remove residual sodium chloride (col. 7, lines 16-30). Claims 12 and 37 disclose separating Ti powder from liquid Na.

Again sintering is to be avoided in separation of the titanium product and this is obtained by control of the titanium product's temperature using sufficient molten sodium metal or dilutent gas (Col. 5, lines 19-30).

Armstrong does not explicitly teach the process steps of claim 1 in decanting the liquid metal and passing liquid reducing metal or a liquid of the original salt constituent through a concentrated product to dissolve or displace salt particulates from the metal particulates.

<u>Keller:</u>

Keller teaches a method of producing metals by reducing a metal halide, forming titanium metal in particular (col. 1, lines 15-22). The reaction crystals are so adjusted that the product titanium consists of large crystals of titanium which can be removed from the reactor as a slurry of crystalline titanium in the molten salt (col. 2, lines 12-16). Keller teaches (col. 3, line 75 to col. 4, line 9) that:

> …the resultant slurry of titanium crystals, molten salt, and excess sodium is then subjected to a separation step **14** which may be a simple decanting operation wherein the excess sodium is removed, as a liquid, from the mixture. Most of the excess by-product salt may also be drained off at this point, and a relatively concentrated mixture of titanium crystals and salt may then be transferred to an aqueous acid leaching bath, indicated at **16.** It is obvious that the titanium crystals must be cooled prior to the aqueous acid leaching step.

This separation process is reflected in Fig. 1 as steps 14 and 16. The titanium product is in such a form that by simply filtration or decantation, the majority of the by-product salt can be separated from the titanium crystals so that leaching is kept to a minimum – which is particularly advantageous when the anhydrous salt is recycled to electrolytic cells for regeneration (col. 2, lines 31-38).

Regarding claim 1, it would have been obvious to one of ordinary skill in the metallurgical arts at the time the invention was made, to combine Armstrong in view of Keller to carry out the process of claim 1 in decanting the excess liquid metal and then reintroducing it into the concentrated slurry of metal particles to further concentrate them. Armstrong teaches that the titanium metal should be maintained below the sintering temperature and that the use of sufficient sodium metal should be used to control the temperature of the metal product (Col. 5, lines 19-34). Throughout Armstrong, sodium metal is used as a heat exchanger fluid and a means to shuttle reactants and products. Reintroduction of decanted sodium is an obvious step in view of the use of sodium as a washing fluid to carry reactants and products in addition to controlling the temperature of the product as a heat exchange medium (Col. 5, line 66 to Col. 6, line 5). Furthermore Armstrong teaches that the reducing agent, sodium, should be recycled (Col. 2, lines 48-54). Keller provides the well-known process of decantation to drain off the excess sodium metal (inherently at a temperature greater than the melt temperature is it is liquid and the salt too is mentioned as being able to be drained off, thus both are liquid) to concentrate titanium product with some residual salt. Lastly, Armstrong teaches a final filtration step where the titanium particles are separated from the remaining original constituents. Motivation to combine the two references comes from the work of both references in addressing the need to separate unwanted constituents from a slurry after formation of titanium metal.

Regarding claim 16, Keller taught decantation of molten sodium from a sodium-salt-titanium slurry. Such a slurry will inherently separate according to density with the denser titanium particles sitting on the bottom (4.55 g/cm^3), molten sodium chloride (2.16 g/cm^3) above it, and then molten sodium metal on top (0.97 g/cm^3). Keller further taught that the salt (sodium chloride) may be drained off from the slurry as well (Col. 5, lines 4-6). Armstrong teaches filtering of a salt-titanium mixture to yield titanium particles (Col. 7, lines 16-30). This mixture can then be cooled in the manner suggested by Keller and then water washed. As for the molten salt being separately prepared, it would have been obvious to one of ordinary skill to separately prepare a molten salt as Armstrong conducts separation in a separate vessel and producing molten salt such as molten NaCl would be simpler than trying to separate NaCl from the existing process stream containing titanium.

Regarding claim 2, a gel will inherently be formed following the removal of liquid metal as the density and viscosity will increase with the removal of liquid after carrying out the process of claim 1.

Regarding claims 6 and 23, Both Armstrong and Keller teach the use of alkali and alkaline earth metals as liquid metals.

Regarding claim 7, Armstrong taught that the titanium product should be kept from sintering, and as the molten sodium - molten sodium chloride mixture is in contact with the titanium product, both should be kept below about 1000 °C (Col. 4, lines 9-11; Col. 5, lines 18-33).

Regarding claims 8, 18, 19, 20, 24 Armstrong teaches that sodium metal can be used with a liquid alkaline metal such as calcium to form a mixture. Upon reaction with a titanium tetrachloride reagent, a NaCl - $CaCl_2$ mixture would inherently form as both metals have a well-known higher affinity for chlorine compared to titanium. Keller also teaches that a mixed salt system of sodium and calcium, magnesium, etc. should be employed to avoid operating at higher temperatures (Col. 6, line 70 to Col. 7, line 13). A eutectic system mixture would be an obvious variation in concentrations of the two salts based on the knowledge of one of ordinary skill in the art as the meaning of a eutectic in having the lowest possible melting point and the general commercial trend to minimize heating in metallurgical processing to minimize operating costs.

Regarding claims 9, 10, 14, and 15, both Armstrong and Keller teach the separation of titanium particles. Furthermore both references teach that titanium alloys can be made (Armstrong: Col. 7, lines 47-51 and Keller: Col. 7, lines 25-35). Ti-6 Al- 4V is the one of the most popular and widely use titanium alloys and one of ordinary skill would clearly see the economic and time-saving advantages of forming alloy particle product of this composition for sale. Furthermore, both Armstrong and Keller teach using sodium metal as the reducing agent to form titanium particles. This sodium metal is well-known to form sodium chloride after reducing the titanium tetrachloride reagent.

Regarding claims 11-13 and 21-22, Keller teaches the decantation of excess molten salt (NaCl) by-product from a titanium-salt-sodium slurry. Being molten, this NaCl liquid with inherently be at a temperature of greater than about 800 °C, which is approximately its melting point. In using a eutectic NaCl-CaCl2 mixture, which was

taught to be obvious in the 103 rejections above, the melting temperature is around 600 °C as taught in the specification (top of p. 5).

Regarding 17, Armstrong teaches a liquid salt of NaCl and salt particulates of NaCl. Similarly, Keller teaches that "from the standpoint of simplicity of operation and ease of control, it is preferred, however, that the salt be the chloride of the reducing agent" (Col. 7, lines 70-73).

Regarding 25, given decantation as a well-known separation process, using suction to remove the liquid metal without removing the metal particulates in the process would be clearly obvious to one of ordinary skill in the art. Allowing metal particulates to escape during the draining of the liquid metal would be completely counterproductive in concentrating the metal particulates and wasteful in that the end product is being moved into another area of the processing system away from the filtration system.

Response to Applicant's Arguments:

4. Applicant's arguments filed September 15th, 2008 have been fully considered but they are not persuasive.

Applicants assert (p. 7, para 1) that the process of the '303 patent (Keller) differ significantly from the process of the present claims because the process involves molten salt.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208

USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Keller is mainly used to demonstrate the desirability of the process of decantation to separate one or more undesired liquids or a liquid phase to concentrate the desired metal particulates.

Applicants assert (p. 7, para 3) that neither reference teaches or suggests the gel formation step or passing a liquid metal or molten salt through the gel at a temperature above the melting point of the salt particles.

In response, it would have been obvious to one of ordinary skill in the metallurgical arts at the time the invention was made, to combine Armstrong in view of Keller to carry out the process of claim 1 in decanting the excess liquid metal and then reintroducing it into the concentrated slurry of metal particles to further concentrate them. Armstrong teaches that the titanium metal should be maintained below the sintering temperature and that the use of sufficient sodium metal should be used to control the temperature of the metal product (Col. 5, lines 19-34). Throughout Armstrong, sodium metal is used as a heat exchanger fluid and a means to shuttle reactants and products. Reintroduction of decanted sodium is an obvious step in view of the use of sodium as a washing fluid to carry reactants and products in addition to controlling the temperature of the product as a heat exchange medium (Col. 5, line 66 to Col. 6, line 5). Furthermore Armstrong teaches that the reducing agent, sodium, should be recycled (Col. 2, lines 48-54). Keller provides the well-known process of decantation to drain off the excess sodium metal (inherently at a temperature greater than the melt temperature is it is liquid and the salt too is mentioned as being able to be drained off,

thus both are liquid) to concentrate titanium product with some residual salt. Lastly, Armstrong teaches a final filtration step where the titanium particles are separated from the remaining original constituents. Motivation to combine the two references comes from the work of both references in addressing the need to separate unwanted constituents from a slurry after formation of titanium metal.

A gel will inherently be formed following the removal of liquid metal as the density and viscosity will increase with the removal of liquid after carrying out the process of claim 1.

Lastly, Applicants assert (p. 8, paras 2-3) that ‘106 patent does not teach adding a slurry from the Armstrong process to a separately prepared molten salt nor does ‘303.

In response, Keller taught decantation of molten sodium from a sodium-salt-titanium slurry. Such a slurry will inherently separate according to density with the denser titanium particles sitting on the bottom (4.55 g/cm^3), molten sodium chloride (2.16 g/cm^3) above it, and then molten sodium metal on top (0.97 g/cm^3). Keller further taught that the salt (sodium chloride) may be drained off from the slurry as well (Col. 5, lines 4-6). Armstrong teaches filtering of a salt-titanium mixture to yield titanium particles (Col. 7, lines 16-30). This mixture can then be cooled in the manner suggested by Keller and then water washed. As for the molten salt being separately prepared, it would have been obvious to one of ordinary skill to separately prepare a molten salt as Armstrong conducts separation in a separate vessel and producing molten salt such as molten NaCl would be simpler than trying to separate NaCl from the existing process stream containing titanium.

Conclusion

-- Claims 1, 2, and 6-25 are rejected
-- No claims are allowed

The rejections above rely on the references for all the teachings expressed in the texts of the references and/or one of ordinary skill in the metallurgical art would have reasonably understood or implied from the texts of the references. To emphasize certain aspects of the prior art, only specific portions of the texts have been pointed out. Each reference as a whole should be reviewed in responding to the rejection, since other sections of the same reference and/or various combinations of the cited references may be relied on in future rejections in view of amendments.

All recited limitations in the instant claims have been met by the rejections as set forth above. Applicant is reminded that when amendment and/or revision is required, applicant should therefore specifically point out the support for any amendments made to the disclosure. See 37 C.F.R. § 1.121; 37 C.F.R. Part §41.37 (c)(1)(v); MPEP §714.02; and MPEP §2411.01(B).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mark L. Shevin whose telephone number is (571) 270-3588 and fax number is (571) 270-4588. The examiner can normally be reached on Monday - Friday, 8:30 AM - 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy M. King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

/Mark L. Shevin/
Examiner, Art Unit 1793

/Roy King/
Supervisory Patent Examiner, Art Unit 1793

November 19th, 2008
10-529,918